Aluminium Alloy Data Sheet

5005

Alloy 5005 is a non-heat-treatable 0.8% magnesium alloy commonly available in flat rolled coil, sheet and plate from a wide range of producing mills. The 5000-series magnesium alloys have a high strengths because of the magnesium addition; 5005 has only a very small addition of magnesium so is the least strength of these series of alloys. The alloy is hardenable to a significant degree by cold working, enabling a series of "H" tempers but again these do not achieve the high strengths of corresponding tempers in other alloys such as 5052 or 5083.

The alloy is also produced as stranded conductor, drawn seamless tube, wire and bar, available on indent from Atlas.

Corrosion Resistance

Excellent in a wide range of atmospheric environments, in architectural applications. The magnesium content is low enough that it does not suffer from the stress corrosion cracking that can affect alloys with more than about 3½% Mg, such as 5083.

Heat Treatment

Alloy 5005 is not hardenable by heat treatment. It can be significantly hardened by cold work (eg by cold rolling) and various "H" tempers are produced – most commonly H32 (¼ Hard) and H34 (½ Hard) – as well as the soft annealed Temper O condition.

The alloy spontaneously age-softens at room temperature immediately after cold work but will eventually reach a stable condition; all flat rolled mill products are supplied with stable properties. This is usually achieved by a stabilisation thermal treatment, either a low temperature thermal treatment or as a result of heat introduced during rolling, which results in the H3x tempers. H2x tempers are more severely strain hardened and then partially annealed, again to quickly reach the required stable temper properties.

To soften Alloy 5005 it can be annealed by heating to 345°C, hold until uniform temperature then cool; the rate of cooling is not important.

Anodising

All aluminium alloys can be anodised to improve corrosion resistance, but decorative anodising is only carried out on a few alloys. The most commonly decoratively anodised non-heat-treatable alloy is 5005. It is produced as a special "anodising quality" (AQ) but Atlas does not stock this product. It is most common and usually successful for general purpose quality (non-AQ) to be anodised; this can however result in some visually inconsistent anodising outcomes and in severe cases in "tiger stripe" appearance. It is always recommended that anodising performance be tested by trialling a piece from a batch of sheet.

AQ sheets can be sourced on indent if required for critical applications.

When anodised, film on 5005 is clearer and lighter than on 3003 and gives better colour match with 6063 architectural extrusions.

Welding

Excellent weldability by all standard methods; gas, electric and resistance welding. GMAW and GTAW are preferred and widely used. Filler alloys are usually 4043 although other alloys are possible. Welding of strain hardened tempers will reduce strengths in the heat affected zones.

Machining

Machinability is poor, with the harder tempers such as H34 and above being somewhat easier to machine.

Typical Applications

Electrical conductor wire, cooking utensils, appliances and widely used as sheet in architectural applications.

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Specified Properties

These properties are specified for flat rolled product (plate, sheet and coil) in ASTM B209M. Similar but not necessarily identical properties are specified for other products such as tube and bar in their respective specifications.

Composition Specification (%)

(single values are maxima except as noted)

Alloy	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others	
									Each	Total
5005	0.30	0.7	0.20	0.20	0.50-1.1	0.10	0.25	-	0.05	0.15

Mechanical Property Specification

(single values are minima except as noted)

Alloy & Temper	Tensile Strength (MPa)	Yield Strength 0.2% Proof (MPa) min	Elongation (% in 50mm) minimum for sheet or plate thicknesses shown				
			0.15-0.32mm	0.33-0.63mm	0.64-1.20mm	1.21-6.30mm	6.31-80.0mm
5005-O	105 - 145	35	12	16	19	21	22
5005-H32	120 - 160	85	-	3	4	7	10 *
5005-H34	140 - 180	105	2	3	4	5	8 *
5005-H36	160 - 200	125	1	2	3	4 *	-
5005-H38	180 min	-	1	2	3	4 *	-

Tempers H22 and H24 etc may not meet maximum tensile strength and minimum yield strength limits, but if supplied in place of ordered H32 or H34 all limits must be complied with.

* properties for H32 only specified up to 50mm, H34 to 25mm, H36 to 4.0mm and H38 to 3.2mm thick.

Specialist tempers such as F, H116, H112 and H141 are also possible in 5052 – refer to standards for details.

Physical Properties

(typical values)

Alloy	Density (kg/m^3)	Elastic Modulus (GPa)	Mean Coefficient of Thermal Expansion 20-100°C (μm/m/°C)	Thermal Conductivity at 25°C (W/m.K)	Electrical Conductivity MS/m at 20°C		Electrical Resistivity (nΩ.m)
					Equal Volume	Equal Mass	
5005	2700	69	23.8	201	30	100	33

Grade Specification Comparison

Alloy	UNS No	ISO	BS	DIN	
				No	Name
5005	A95005	AlMg1	N41	3.3315	AlMg1

These comparisons are approximate only. The list is intended as a comparison of functionally similar materials **not** as a schedule of contractual equivalents. If exact equivalents are needed original specifications must be consulted.

Possible Alternative Alloys

Alloy	Why it might be chosen instead of 5005
3003	Brighter appearance required, particularly when considering treadplate.
5052	Higher strength or treadplate required. Decorative anodising not required.
5083	Higher strength or improved corrosion resistance required, particularly for ship hull applications.

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Bending Radii

Minimum Bend Radius for Sheet or Plate thickness "t"								
Temper	**0.4mm**	**0.8mm**	**1.6mm**	**3.2mm**	**4.8mm**	**6.0mm**	**10mm**	**12mm**
O	0t	0t	0t	0t	½t	1t	1t	1½t
H32	0t	0t	0t	½t	1t	1t	1½t	2t
H34	0t	0t	0t	1t	1½t	1½t	2t	2½t
H36	½t	1t	1t	1½t	2½t	3t	3½t	4t
H38	1t	1½t	2t	2½t	3½t	4½t	5½t	6½t
Recommended minimum bending radius for sheet of thickness given, at 90°to the rolling direction. These values are recommended but are not guaranteed; the minimum possible bend radius will depend on the type of bending equipment and on the tooling and its condition.								

References

- ASTM B209M – 10. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- Aluminum Association – Aluminum Standards And Data – 2009 Metric SI.
- WTIA Technical Note 2 – Successful Welding of Aluminium.